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Conceptual analysis of diabetic retinopathy in Ayurveda

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ABSTRACT

Inclusion of *Prameha* among the eight major disorders in *Charaka Samhita* shows the significance of the disease given by ancient seers. The risk of development of blindness in diabetics increases by 20–25 times as compared to the normal population. High prevalence rate of Diabetic Retinopathy (34.6%), proliferative diabetic retinopathy (7%), diabetic macular edema (6.8%), and Vision threatening Diabetic retinopathy (10.2%) in diabetics was great concerns which led to search and analyze the disease process on the basis of modern pathogenesis and different *Timirvyadhi* mentioned in Ayurvedic authoritative texts. Thus the present study endeavors to discuss the similarities and differences among the various components of *Prameha*/*Madhumehajanya Timir* with Diabetic retinopathy and its stages. To establish a probable etiopathogenesis of the disease from Ayurveda prospective, all the important literature of both modern medicine and Ayurveda along with online sources were searched and analyzed. All the three *dosha* along with *Raktadosha* and *Saptadhatu* with four internal *Dristipatals* of eye are affected in *Madhumehajanya timir* in different stages of the disease. *Avarana* and *Dhatu kshaya* too have important role in development of diabetic retinopathy due to prolonged and uncontrolled hyperglycemia. *Agnimandya* related *Ama* formation has a role in pathology of diabetic retinopathy which is quite similar to oxidative theory of diabetic retinopathy explained in modern pathology. *Urdhwaga raktapitta*, *Ojas kshaya*, *Raktavritta vata*, and *Pranavritta vyana* are other causes in development of diabetic retinopathy.

1. Introduction

Diabetes mellitus has in recent times, gained importance as one of the most common, non communicable disease, which contributes to death and disability worldwide. Diabetes affects almost all aspects of intermediary metabolism and is also associated with accelerated aging of the cardiovascular system. Hence diabetes is best defined as a metabolic cum vascular syndrome of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both, leading to changes in both small blood vessels (microangiopathy) and large blood vessels (macroangiopathy) and which is often associated with long term damage, leading to malfunction and failure of various organs like eyes, kidneys, heart, nerves and blood vessels [1].

Diabetic retinopathy is a chronic progressive, potentially sight-threatening disease of the retinal microvasculature associated with prolonged hyperglycemia and other conditions linked to diabetes mellitus such as hypertension, hyperlipidemia and proteinuria etc. [2]Almost all the patients with Type I diabetes develop retinopathy in about 15 years. In those with Type II diabetes, the risk of DR increases with the duration of diabetes, accompanying hypertension and smoking. Diabetics have a 20–25 times greater risk of blindness as compared to the normal population [3]. As far as the working class or industrial areas are concerned Diabetic Retinopathy is 2nd leading cause of blindness in working age group (<55 years old) in industrialized countries [4].

Diabetic Retinopathy (DR) is one of the major complications of diabetes mellitus. It is a leading cause of blindness in developed as well as developing countries. According to VISION 2020 (Working together to eliminate avoidable blindness) up to 80% of the world's blindness is avoidable. Avoidable blindness is defined as blindness which can be either treated or prevented by known, cost-effective

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means. Although there are many other causes of vision impairment, VISION 2020 seeks to address the main causes of avoidable blindness, in order to have the greatest possible impact on vision loss worldwide. Diabetic retinopathy is one among the target diseases for VISION 2020 [5].

The prevalence of DR, proliferative diabetic retinopathy (PDR), diabetic macular edema (DME), and VTDR (Vision threatening Diabetic retinopathy) among individuals with diabetes is 34.6%, 7.0%, 6.8%, and 10.2%, respectively. Estimate shows that the number of people with DR will grow from 126.6 million in 2011 to 191.0 million by 2030, and the number of people with VTDR will increase from 37.3 million to 56.3 million, if no urgent action is taken [6]. Innovative alternative therapies and comprehensive approaches are needed to reduce the risk of vision loss by prompt diagnosis and early treatment of Vision Threatening DR (VTDR).

After viewing the magnitude of the problem of the disease, a comprehensive and thorough analysis of all the important literature of both modern and Ayurveda was done and online sources are searched to establish a probable etiopathogenesis of the disease on Ayurvedic prospective. Though there are no direct references are available regarding *Madhumeha/Prameha janya Timir*, enough evidences are available in all leading treaties of Ayurveda, which substantiate that *Timir* can be a complication of *Madhumeha*. In this review study many aspects of basic concepts of Ayurveda were analyzed to find out the probable etiology and pathogenesis of Diabetic retinopathy with probable correlation of different stages of the disease with different types of *Timir* described in Ayurvedic literature.

2. *Samprapti* (pathogenesis) of diabetic retinopathy

2.1. Role of Raktapitta in manifestation of diabetic retinopathy

Diabetic retinopathy basically a *Dristipatalagata roga* is mainly attributed to *Sira srotasabhisyandam* and *raktavaha sroto dusti* due to a variety of *Achakshyushya ahara* and *vihara karanas* especially in *Prameha* patients. In order to understand the *samprapti* of diabetic retinopathy in Ayurveda, general *samprapti* of eye disease must be considered. *Nidana* of endogenic eye diseases are mainly *Achakshyushya* factors which vitiates *Pitta*. The vitiated *Pitta* in turn vitiates the *Pitta vaha srothas*. Due to interconnection of *Pitta* and *Rakta*, which shares *Ashrya Ashrayee bhava,* the *raktavaha srotas* is also gets vitiated due to *Pitta* vitiation. As the *nidana* factors are *Achakshyushya*, the vitiated *pitta* and *rakta* have an affinity towards penetrating the eyes. Hence the vitiated *dosha* move towards the eyes through *Jatroordhwa srotas* and finally gets confined to the eyes, there is a stage when the *Sirasrothas* are deeply involved which is known as *Sira abhisyanda* [7]. The whole pathology of diabetic retinopathy which starts with *sroto dusti of Raktavaha srotas* manifested as microangiopathy in the form of *Attipravriti, Sanga* and *Granthi* as haemorrhages, exudates and venous beading in diabetic retinopathy respectively.

In this context of *Siroabhisyandam* in eye diseases the *Ashraya sthana* is *Srotas*, affected *dhatu* is *Rakta* and vitiated *dosha* is *Pitta*. *Prameha* brings out changes in the *dristipatalam* which greatly affects vision. In the initial stage, the etiological factors promote *utklesa* in the vessels which causes changes in the permeability of the vessels especially of head region which is the basic pathologic change for the development of eye diseases. If the stage of *Sira abhisyanda* continues it spreads to *netrasrotas* and the same vascular changes takes place in the vessels of eye, because *Achaksyushya* factors always have affinity towards the ophthalmic tissues. In the stage of *netraabhisyandam*, if there is further vitiation of *Pitta dosha*, the condition further aggravates and will be confined to *Dristipatalam*.

Few predisposing factors also influence the development of eye disease associated with prameha. These include- 1. *Pittaprakritti* of the patient. 2. Hereditary factors 3. Pitta Kapha predominant season, foods and psychological stress factors like *krodha, soka* etc., which contribute towards vitiation of *Pitta*. Vitiated *Pitta* reaches and amalgamated with *Rakta dhatu* due to similar properties. All these factors altogether promote prominent changes in the vessels of *Dristipatalm*. The texture of the vessels is damaged and hence the permeability increases. This results in leakage and hemorrhages from the blood vessels. The blood oozes out like sweat. This again correlates with pathogenesis of *Raktpitta*, specially quoted by *Charaka*. Due to lack of circulation there is localized hypoxia which results in development of new vessels. As these vessels are fragile they bleed easily. Exudates formation, neovascularization and proliferation of the tissues which leads to degenerative changes in the retina. In this context *Urdhwaga Raktapitta* can be correlated with Diabetic Retinopathy, as the seat of *Urdhwag Raktapitta* are all the seven natural openings of the head. And in eye, as the vessels are minute and due to *achakshyushya* factors the vessels of *dristipatala* or retina are affected mostly [Fig. A.1].

2.2. Avaranajanya, Dhatukshyajanya Timir and diabetic retinopahy

According to *Vagbhata*, *Madhumeha* is chronic progressive stage of *Prameha* and of two types: *Avaranajanya* and *Dhatukshyajanya* [8]. *Madhumeha* is *Vataja* type of *prameha* and *Vata* can be aggravated by two ways i.e. *Avarana* and *Kshaya* [9]. *Avritta vatajanya madhumeha* is *krichhrasadhya* and *dhatukshyajanya madhumeha* is *asadhya* (incurable). As per charak "*prameha anusanginam*" means diabetes is concomitant in nature. Thus diabetes remains always present with its complications. Due to both *avarana* and *dhatukshya* all the ten *dushyas* goes into state of depletion and produce symptoms according to the seat of that particular *dhatu*. In the case of Diabetic retinopathy main affected *dhatu* is *Rakta dhatu*, though all the *dhatus* gets affected and *srotas* affected are *Raktvaha*, *mamsavaha* and *medovahasrotas* mostly. List of *doshas*, important *dushya*, *dhatu kshaya* symptoms, *srotas* affected and their modern interpretation for pathogenesis of Diabetic retinopathy are mentioned in Table A.1.

2.2.1. Avarana

A. ***Pranavritta vyana***: *Pranavayu* acts like a controller. It is responsible for *Adana karma*. Sense organs perceive their objects with the help of *Pranavayu*. *Vyanavayu* is responsible for gati or conduction. Hence *vyanavayu* plays a significance role in *Rasavikshepana*. Conduction is not only related to cardiac cycle but all types of neural conduction should be considered. Whenever the controller *Pranavayu* will restrict the gati of conducting *vyanavayu*, the *Indriya* will not be able to perceive its *visaya*. It may happen in one *Indriya* (homonymous) or in all *indriyas* (heteronymous) together. If it happens in all indriyas it can be compared with the vegetative stage or deep coma. *Rasa-Rakta vikshepana* (blood circulation) is function of *vyanavayu*. In case of diabetic retinopathy vascular disorder may arise due to *Pranavritta vyana*. This initially causes retinal ischemia and followed with successive cascade of retinopathic changes like neovascularisation, cotton wool spots and intra retinal microvascular abnormalities (IRMA). Early break down of blood retinal barrier (BRB), hard exudates formation and macular edema are other symptoms to follow. Symptoms of *Pranavritta vyana* are *Sarva indriya sunyata*, *smriti kshaya* and *bala kshaya* and the treatment is *Urdwa Jatrugata cikitsa* (Tripathy Brahmananda, 1999, Caraka Samhita, Chikitsa Sthana, 28:202; P 974). In

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